These are :—

1. That it is sometimes difficult to adjust the angle of the film so as to get the best light on it.

2. It is impossible to vary the distance of the film from the mouth so as to use both loud and faint sounds.

3. There is no means of adjusting the tension of the film.

My phoneidoscope, which is free from these defects, and which I have found to work exceedingly well, simply consists of the hand and some soap-suds. The forefinger and thumb being bent so as to form a circle, a soap film is drawn across them with the other hand. By turning the wrist, the angle which the film makes with the direction of the light can be accurately adjusted.

A motion of the elbow alters the distance from the film to the mouth, and by slightly separating or bringing together the finger and thumb, the tension of the film can be exactly regulated so as to give any degree of sensitiveness that may be desired.

The extra delicacy obtained by this adjustment much more than counterbalances the absence of the tube and mouthpiece.

Pixholme, July 30 J. E. H. GORDON

Spectrum of the Electric (Jablochkoff) Light

I WOULD suggest that when your readers visit Paris they should take their pocket spectroscopes. They will find a very interesting spectrum in the electric lamps now being used for lighting some of the principal public places in the city. One might have expected to have found from the brilliant spark inclosed in a white opaline globe a continuous spectrum such as is afforded by the voltaic arc. But the contrary is the case. The Jablochkoff candle now in use in Paris, even when viewed by one of Browning's small pocket instruments, presents a very complicated and highly interesting spectrum. I had no chart with me for comparison, nor did I, as I intended subsequently, make even a rough record of the spectrum; but speaking from memory, I may say that several lines in the blue and green were very marked and distinct, and, in fact, the whole spectrum was traversed by bright and dark lines. I thought, probably, some of these dark lines might be due to absorption by the white opaline glass globe, but I have tested several specimens of this white glass, and I find it does not alter in any way (except by generally reducing its brilliancy) a continuous spectrum, nor does it change the character of the solar spectrum. We must, then, turn to the light itself and to the atmosphere surrounding it for the cause of these phenomena. I believe that in a chemical sense there is no difference between the ordinary electric arc between the carbon points and the arc of the Jablochkoff candle, except that between the carbon points of the latter is a rod of kaolin, which has, I think, a calcium base. This kaolin is intensely heated by the current, and is volatised at the same rate as the carbon rods by the alternative current which this form of candle requires. The light, therefore, is a combination of the electric and the lime light, the current taking the place of the oxy-hydrogen elements. The surrounding atmosphere will be the same in both cases, but the products of combustion will obviously be different, and partly so from the composition of the kaolin. Still, I confess that I cannot suggest the cause of this complicated spectrum, and I hope that some observers who have more accurate means and more experience will give us the *rationale* of the phenomena.

I may say that there is not at present any Jablochkoff candles to be seen in use in this country, but in the course of two or three weeks they will be introduced into a large establishment, where excellent means of observation will be afforded.

Royston House, Tottenham, July 27 E. WALKER

P.S.—Since forwarding the above I have observed the Loutin light now on view at the Gaiety Theatre. The spectrum is somewhat similar to that of the Jablochkoff light, but much less distinct. This is probably owing to the circumstance that at the Gaiety the arc is inclosed in a small opaline globe, which is itself encased in an ordinary ground glass lanthorn (the proper lamps came to grief in transit), this diffusive ground glass causing, by overlapping, the indistinctness. Still there are absorption bands and some remarkable bright lines, which, with my small pocket instrument, I will not attempt to define. Nor, as it is a matter for careful observation, will I speculate further than to suggest—seeing that the Loutin light is from the carbon points only—that the white opaline glass may exercise a selective power over the spectrum given by this high state of incandescence which it does not in ordinary cases, and may give us also, to an extent, the actual wave due to a particular element rather than its obscuration. If so the Loutin light should differ somewhat from the Jablochkoff light, being deficient of the kaolin. E. W.

The Meteor Showers of July

THE prominent shower of *Aquarids* mentioned in my letter in NATURE, vol. xviii. p. 356, had become extremely feeble on July 31 and August 1, for of 136 shooting stars seen on those nights only three or four were conformable to that radiant point which, from a careful re-examination of all the paths recorded from it, is situated exactly at 341°—13°, near δ Aquarii (from fifty-four meteors).

Between July 26 and August 2 403 shooting stars were recorded here, of which no less than sixty-three (including one perfectly stationary) belonged to a very sharply-defined radiant near χ Persei, at 32° + 53°. Fourty-four of these were noted on the three nights, July 30-31 and August 1, when the shower appeared to attain its full intensity. The meteors were very swift with short paths (of about 7°), and almost invariably left streaks of 3° or 4°. They were shorter and less bright than the August *Perseids* at 43° + 58°, and in strong contrast to the long, slow meteors of *Aquarids* seen on the few preceding nights. This very rich stream at 32° + 53° has escaped previous detection, for, being near the date and position of the August *Perseids*, there can be no doubt that its meteors have in past years been attributed to that well-known shower, and given it an undue extension of period. The two radiants are, however, quite distinct, and it is now easy to explain the statements of some observers that there are many *Perseids* visible during the latter part of July. I believe that but few of the old *Perseids* can be seen before August 6 or 7. My own observations this year show that only seven or eight were seen before August 2, though I watched that region in which the radiant lies very carefully, and noted 400 meteors amongst the constellations there!

Thus at the end of July we may expect two special meteor showers: one of *Aquarids*, at 341°—13°, the other of *Perseids*, 32° + 53°. The former comes to a maximum two or three nights earlier than the latter, which may be called the "*Perseids* II.," in order to distinguish them from the old *Perseids* of Heis.

Ashleydown, Bristol, August 3 W. F. DENNING

The Rainfall of Brazil and the Sun-Spots

AN examination of the scanty records of rainfall obtainable in Brazil proves that the relation between rainfall and sun-spots, which has been pointed out in India by Dr. Hunter and others, holds good for the inter-tropical portion of Brazil.

The only stations from which I have been able to obtain records for a series of years are the city of Fortaleza (better known in Europe as Ceará), in latitude 3° 42′ S., and Rio de Janeiro, in latitude 23′ S. The rainfall of these two stations is shown in series in the following table :—

Series of Years in the Cycle of Eleven Years.	Average relative Annual Number of Sun-Spots, 1811-1875.	Mean Annual Rainfall of Ceará, 1849-1877.	Mean Annual Rainfall of Rio de Janeiro, 1851-1877.
		March.	June.
Minimum 11th Series ...	16·3	1429·3	1134
Group 1st & 2nd Series	10·8 mean.	1298·6 mean.	986 mean. 1032·6
3rd and 4th Series	48·6	1493·8	1039·2
5th ,, 6th ,, ...	88·3	1587·7	1011·2
7th ,, 8th ,, ...	65·3	1608·1	1355·3
9th ,, 10th ,, ...	38·5	1252·6	1139·3
11th ,, ...	16·3	1429·3	1134

The northern provinces of Brazil outside of the Amazon valley, and notably that of Ceará, are subject to severe and prolonged droughts, of which that of 1877 is one of the most terrible on record. The annals of Ceará make mention of thirty years of drought since 1711, many of which, however, were only partial or slight, and many of which occurred in groups of consecutive years, there being one group of five dry years, another of four, and four groups of two years each. Twelve notable floods are also recorded since 1776. The droughts and floods are distributed as follows, among the groups of the years of the sun-spot cycle, proposed by Dr. Hunter :—

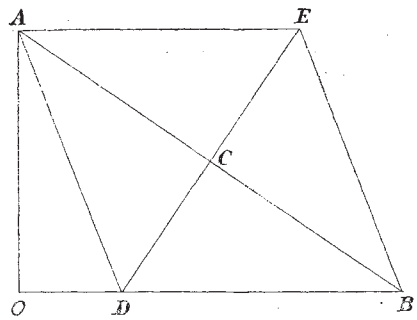
	Droughts.	Floods.
Minimum Group (11th, 1st, and 2nd Series)	13	2
Intermediate Group (3rd, 4th, 9th, and 10th Series) ...	10	4
Maximum Group (5th, 6th, 7th, and 8th Series) ...	7	6

Of the seventeen cycles of eleven years, between 1711 and 1877, only three have no record of one or more dry years. The great droughts were those of 1722, 1778, 1792, 1825, 1845, and 1877, of which four occurred in the minimum group, one commenced in that group, but culminated in the intermediate group, and one was confined to the latter group.

Rio de Janeiro, June 12 ORVILLE A. DERBY

The Cell of the Bee

THE following simple construction shows in one figure all the elements of a cell of a honey-comb. On two rectangular axes take OA and OB equal to the side and diagonal of a square. Join AB and bisect it in C. Draw CD normal to AB. Join AD, and complete the rhombus whose sides are AD, DB. Then if OA be a side of the hexagon, ADBE is one of the three equal planes forming the trihedral angle which closes the cell. The three short diagonals DE meet in the vertex of the cell, and are



normal to each other. The three long diagonals AB form an equilateral triangle. OD is the height of the vertex above the hexagonal face of the prism. AED is the angle which the axis of the prism makes with each of the diagonals DE. ADO is the angle which the axis of the prism makes with each of the edges of the trihedral angle. The diagonals DE and AB are in the ratio of the side and diagonal of a square. Such a cell contains a maximum volume with a minimum surface.

Bardsea EDWARD GEOGHEGAN

OUR ASTRONOMICAL COLUMN

THE REPORTED OBSERVATION OF "VULCAN."—In the telegram received from Mr. Lockyer relating to the solar eclipse which appeared in NATURE last week (p. 353), and which, like many other similar messages, had suffered in course of transmission, mention was made of Prof. Watson's observation of an object of 4½ magnitude in R.A. 8h. 26m., and declination 18° 0′ north, which was neither a known planet nor a star. θ Cancri, a star of the fifth magnitude, is less than a degree from this position, but the observer would doubtless be aware of its presence. A telegram to the same purport was received by M. Mouchez, the director of the Observatory at Paris. By the formula deduced by Leverrier from the observations of suspicious objects in transit across the sun's disc, if the indeterminate k be put = 0, the elongation in longitude of his hypothetical body from the sun's centre at the time of totality at Prof. Watson's station would be 5°·9 eastward, and if $k = -1$, 9°·5 westward, neither of which, it will be seen, accords with the position given in the telegram. The fourth-magnitude star, δ Cancri, must have been within the limits of the coronal surroundings of the sun, and was only just beyond them during the total eclipse of July 28, 1851, when no observer, to our knowledge, remarked the star. In the instructions for observing the eclipse issued from the United States Naval Observatory, Washington, and prepared by Prof. Harkness at the instance of Admiral Rodgers, the superintendent, it is remarked: "As the truth of Leverrier's discovery of an apparently unexplained motion of the perihelion of Mercury is now established beyond all doubt, it is important to renew the search for an intra-Mercurial planet or planets." And to facilitate the work of such astronomers as might institute a search with considerable telescopic power, a chart was appended to the instructions showing every star so large as the seventh magnitude in that portion of the heavens occupied by the sun at the time. This chart extends from 7h. 32m. to 9h. 40m. in right ascension, and from 11° to 26° in declination. θ Cancri, the only star which appears near the position indicated for Prof. Watson's object, is marked on the chart as a sixth magnitude, which is the estimate of the *Uranometria* and *Durchmusterung*, but the star has been occasionally rated a fifth magnitude as in the first Radcliffe Catalogue, wherein particular attention was paid to the brightness of the stars. This is only a half-magnitude below Prof. Watson's estimate, but it remains to be seen from further intelligence whether there was any possibility of the star having been the object really noted; if it were separately remarked, or if the observed position does not admit of such change as would be necessary for identification, then it may truly be said that the American astronomer will have rendered the occasion of this eclipse a memorable one in the history of the science. Leverrier's confidence in the existence of an unexplained motion in the perihelion of Mercury and the necessity of accounting for it, by admitting the presence of matter in some form within the orbit of the planet, continued undiminished up to the time of his decease. One of his last communications to the writer of these lines was upon this subject.

THE LUNAR ECLIPSE ON AUGUST 12.—The eclipse of the moon on August 12 is the only one that will be wholly visible in this country until the year 1884; first contact with the earth's dark shadow at 10h. 42m., the middle of the eclipse at 12h. 8m., magnitude 0·59, and last contact at 13h. 34m. On October 4, 1884, there will be a total eclipse of the moon, the middle near 10 P.M., and the passage through the shadow nearly central.

THE AUGUST METEORS.—The earth will arrive at the descending node of the orbit of the comet 1862 III., in the track of which the meteors of the August period are found to move, soon after noon on Saturday next; the comet itself has now receded from the sun to a distance nearly equal to the mean distance of Neptune, to return to these parts of the system probably between 1980 and and 1985. Moonlight interferes this year with observation of the smaller meteors August 9-11, during a part of the night.

TEMPEL'S COMET.—The following places of this comet are deduced from M. Schulhof's elements, with the time of perihelion passage, corrected by the early observations at Strasburg by Prof. Winnecke:—

12h. G.M.T.	Right Ascension.	North Polar Distance.	Log. Distance from Earth.	Intensity of Light.
	h. m. s.	° ′		
August 23	16 20 30	109 3	9·9018	0·86
,, 25	— 25 55	109 52		
,, 27	— 31 28	110 40	9·9079	0·84
,, 29	— 37 12	111 27		
,, 31	— 43 6	112 13	9·9144	0·82
September 2	— 49 10	112 58		
,, 4	16 55 24	113 42	9·9213	0·80
,, 6	17 1 48	114 24		
,, 8	— 8 22	115 5	9·9286	0·77
,, 10	— 15 5	115 44		
,, 12	— 21 58	116 22	9·9365	0·74
,, 14	— 29 0	116 58		
,, 16	17 36 11	117 33	9·9448	0·71

On September 10 the comet passes very near to the orbit of Mars, but the planet is far distant. The dimen-